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WARREN DE LA RUE, Esq., President, in the Chair.

A List of New Double Stars discovered by the Rev. W. R. Dawes.

It seems to be desirable to direct attention to newly discovered double stars, that the question of their physical connection may be determined by observations instituted by such amateurs as possess instruments suitable for the work. I therefore beg to present to the Society the following list of such objects, containing those which have been met with by myself; for, though a few of them have been already published from time to time soon after their discovery, they have never been collected together so as to be readily referred to; and it is therefore very probable that they are little known, and have been but seldom observed. Most of them were casually picked up on nights too unfavourable for satisfactory measurements, and with no very high powers, seldom exceeding 300. As I have employed very little time in sweeping for such objects, it seems probable that an amateur observer possessing sufficiently powerful means, and disposed to devote himself steadily to it, might add materially to the number. And though it is very probable that by far the greater portion of the excessively unequal pairs are only *optically* double, yet the example of that

highly interesting binary couple δ *Cygni* may encourage the hope that other similar instances may be discovered.

The following list is arranged in the order of the date of discovery in preference to that of right ascension, to prevent the necessity of any disturbance of the current number, if others should hereafter be added:—

No.	Designation of Star.	R.A. 1860. h m s	N.P.D. 1860. ° ′	Magnitudes.	Appr. Pos. °	Appr. Dist. ″	Date of Discovery.
1	P. xx. 177	20 24 29	79 12·6	8, 8½	210	0·6	1840, Oct. 26.
2	P. xxiii. 100	23 23 25	32 13·4	7½, 10	225	1·5	1841, Oct. 6.
3	L. 10567	5 29 2	95 43·2	7½, 8	185	0·8	1847, Nov. 1.
4	42 Orionis	5 28 29	94 56·0	5, 9	220	1·8	1847, Dec. 12.
5	η Orionis	5 17 26	92 31·8	4, 5	87	1·0	1848, Jan. 15.
6	Bessel (Weisse) V. 520.	5 21 58	93 25·3	7·2, 7·5	80	0·8	1854, Jan. 8.
7	Procyon	7 31 59	84 25·0	1, 11½	285	47±	1858, Feb. 8.
8	L. 2362	1 11 59	46 46·9	7·7, 9·0	140	2·6	1858, Nov. 11.
9	L. 35816	18 59 58	46 19·8	7·3, 11	180	2·1	1859, Aug. 15.
10	* Vulpeculæ	19 42	66 6	8, 9	314	0·45	1859, Aug. 15.
11	L. 38337	19 56 35	50 5·2	8, 10½	290	6	1859, Sept. 14.
12	* Vulpeculæ	20 3 6	61 42	8, 12	90	12	1859, Sept. 14.
13	L. 37672	19 40 21	45 24·6	7·2, 11·5	267	2	1859, Oct. 5.
14	L. 42263	21 34 0	47 21·2	8, 11½	353	4	1859, Oct. 22.
15	L. 42240-1	21 33 0	47 20·4	7½, 10½	72	1·5	1859, Oct. 24.

A few remarks on some of those objects may be interesting.

1. P. xx. 177. The duplicity of this star was discovered when I was observing at Mr. Bishop's Observatory in the Regent's Park, and with his 7-inch object-glass. It is the star B of Σ. 2690, a wide pair, which was measured by Struve at Dorpat on four nights: on the first with power 480, and on the other three with 320. As such a star ought to have been *fairly divided* by the Dorpat refractor, yet on no occasion was perceived to be even elongated, it seems almost necessary to conclude that it must have come out rapidly during the eight or ten years which intervened between Struve's observations and mine. Yet occasional examination up to the present time has failed to show any perceptible change either in angle or distance; so that much doubt is thrown on what would otherwise have been a satisfactory solution of the difficulty. And it is almost unaccountable that while the two disks of A and B are just neatly separated by my 8¼-inch object-glass, Professor Mädler has recorded fourteen sets of measures of the wide pair with the Dorpat 9·6-inch refractor without giving the slightest intimation of the duplicity of the smaller star! Up to the

present time I am not aware of any measures of this interesting object except my own and Admiral Smyth's.

2. P. xxiii. 100. For the circumstances attending the discovery of the close companion, see Smyth's *Cycle*, No. 839. This star cannot be Σ 3022; for, though the place nearly agrees, and the position angle is only $4\frac{1}{2}°$ greater, the distance of Σ's star is $20''{\cdot}5$. I am not acquainted with any other measures than my own. There is probably another double star in the neighbourhood.

3. L. 10567. A very close and delicate pair. See *Monthly Notices*, vol. viii. p. 31.

4. 42 *Orionis*. It seems surprising that this beautiful object should not have been detected by Struve as a double star. Yet the closeness of the components, and their great difference in brightness, combined with their moderate altitude at Dorpat, would render the duplicity difficult to detect, especially with the low power (198) used by Struve in sweeping for new double stars. It is more surprising that it, as well as No. 3, escaped the scrutiny of Sir John Herschel at the Cape with the 20-foot reflector.

5. *ν Orionis*. This is a very interesting object, and undoubtedly *binary*. It was scrutinised by Sir W. Herschel, who noted a faint distant star, and, consequently, placed it in his sixth class of double stars. But, as he perceived no elongation, and Struve also regarded it as single in 1826, it must have come out since, and the distance has certainly increased during the last ten years, while the angle has remained very nearly stationary.

6. Bessel (Weisse) v. 520. An elegant little object. The magnitudes were obtained by gauging with apertures; as is also the case in the other instances where the magnitudes are noted to tenths of a unit.

7. The small star north-preceding *Procyon* is too distant to constitute it properly a double star; yet, as one star seems to have disappeared from the neighbourhood, it was thought well to put this on record. I have since heard that this minute object has been discovered independently at Mr. Barclay's Observatory; but I am not aware of the date.

8. L. 2362. This double star is so easy that it seems impossible for it to have been overlooked at Dorpat, and again at Poulkova, if it had been at all like what it is now. There is, therefore, great probability of its turning out to be binary.

9. L. 35816. A very delicate object and forming a good test of defining power. It was discovered in sweeping with Alvan Clark's $8\frac{1}{4}$-inch object-glass, with which the small star bears sufficient illumination to permit good measures of distance to be obtained with the filar micrometer.

10. In *Vulpecula*. An excessively difficult object; also discovered with the same object-glass. There is no doubt of

its duplicity. When best seen the elongation was deeply notched, and a dark line seen across the disk, which might be mistaken for a separation.

11. L. 38337. Not difficult; and it is rather surprising it should have been overlooked.

12. In *Vulpecula*. Found in sweeping with power 300 on the $8\frac{1}{4}$-inch object-glass, with which it is nearly the *min. vis.* on an ordinary clear night.

13. L. 37672. An exceedingly delicate and pretty object, found in sweeping with the same power on the $8\frac{1}{4}$-inch object-glass. It is almost exactly south of δ *Cygni*, at a distance of about 11′.

14. L. 42263. The companion is very minute. Found in sweeping with the $8\frac{1}{4}$-inch object-glass, with which the small star was instantly perceived. There are two other very small and more distant stars in the *n. f.* quadrant.

15. L. 42240–1. A rather difficult test, found with the same object-glass and power 300. I have obtained several sets of measures both in position and distance with the filar micrometer. The smaller star strikes me as being of a pale lilac, and requires caution in illuminating the wires.

It may, perhaps, be of some interest to add, that in the immediate vicinity of α *Aquilæ* there is a cluster of extremely small stars, *seven* of which are in the north-preceding quadrant, and nearer to α than the well-known companion of about the ninth magnitude, which is in the same quadrant, and about $2\frac{1}{2}$′ from α. There is also a delicate star following α, and a little to the north; and the 10th mag. star in the *n. f.* quadrant, and about 3′ distant, has two very delicate close companions. But most of the minute points near very bright stars are, as in the case of *Sirius*, tests rather of the purity of the atmosphere than of the defining, or even the illuminating, power of the telescope. Yet, in accordance with the motto of our Society, it may be well to *note* such objects, especially as tending to throw light on the interesting question of physical connection between the more brilliant stars and any faint points of light very near them.

Hopefield Observatory, Haddenham, Bucks,
March 9, 1864.

Note on the frequent omission of Readings of the Barometer and Thermometer in Sextant Observations, for the Determination of Latitude and Longitude. By Edwin Dunkin, Esq.

In offering the following remarks on a subject which has lately given me much trouble, I think it may be useful to call the attention of those members of the Society who are interested in astro-geographical investigations to a most important fact. It appears that, in the determination of latitudes and longitudes by the sextant, while the greatest care has generally been taken by travellers in the astronomical part of the observations of meridian altitudes, local time, or lunar distances, leaving really nothing more to be desired in that direction;—corresponding observations of the variations in the condition of the atmosphere are frequently omitted, notwithstanding that they are such important elements in the deduction of the proper correction for refraction. This omission is to be regretted, even when the traveller keeps a meteorological journal, as the observations in this instance are generally confined to a few readings daily, which differ considerably, especially the temperature, from what would be recorded about the time of the sextant observation.

These few considerations have occurred to me during the discussion of Capt. J. H. Speke's astronomical observations, the reduction of which was performed under my superintendence. So far as Capt. Speke's observations are concerned, I have nothing but the most unqualified commendation, and I have felt personally indebted to him for the general accuracy and order, as exhibited in the whole of his astronomical records from Zanzibar to Gondokoro. The object of these remarks is, therefore, not to complain of, or even to criticise, what is already performed, but simply to offer a suggestion which might be available for the future.

As a result of the absence of corresponding meteorological observations, I have been informed that it has frequently been the practice in the reduction of lunar distances, &c. to extract the correction for refraction from a table, constructed with a barometer reading of 30 inches and a thermometer reading of 50°, without any regard to the condition of the atmospheric pressure, or of the temperature of the air at the time of observation. For nautical purposes, this rough method may in general be sufficiently accurate, but when the observing station is elevated several thousand feet above the level of the sea, and when the resulting longitude is intended to fix permanently the geographical position of the place, the effect of the decreased atmospheric pressure becomes of the highest importance, and ought on no account to be neglected.

To exhibit the effect of this omission, I have given as examples, though by no means extreme cases, two different

results for longitude with the lunar distances corrected and uncorrected for the variations in the readings of the barometer and thermometer. In the reduction of Capt. Speke's astronomical observations, I was obliged to assume these readings, in consequence of no recorded barometric readings having been placed in my hands; but, fortunately, scarcely any ill effect arose from this circumstance, as I found subsequently from an examination of some observations of the temperature of the boiling point of water made during the route, that my assumed readings differed very little from the truth.

From the mean of a series of sextant observations made at Kazé by Capt. Speke, on 1861, February 28, at $20^h\ 25^m\ 34^s$ local time, it was found that the angular distance, at that time, between the Sun and Moon, when cleared from refraction and parallax, was $123°\ 10'\ 28''$ corrected, and $123°\ 11'\ 4''$ uncorrected. These values give for longitude:—

	h	m	s			°	′	″	
Corrected	2	12	4	E.	=	33	1	0	E.
Uncorrected	2	13	8		=	33	17	0	
Difference		1	4		=		16	0	

Again, in 1862, December 12, at Faloro, at $20^h\ 37^m\ 27^s$ local time, the angular distance between the Sun and Moon was found to be $103°\ 39'\ 1''$ corrected, and $103°\ 39'\ 25''$ uncorrected; the resulting values for longitude being:—

	h	m	s			°	′	″	
Corrected	2	7	25	E.	=	31	51	15	E.
Uncorrected	2	8	15		=	32	3	45	
Difference		0	50		=		12	30	

I think these differences are sufficiently important to attract the attention of those who may in future be called upon to make or reduce similar astronomical observations for geographical purposes. They also justify me in laying the subject before the Society. I would, therefore, most strongly recommend that future travellers should be specially instructed to record, not only the readings of the chronometer and sextant, but also the readings of the barometer and thermometer *at least once* during each series of observations. If they will faithfully do this, they will greatly relieve the mind of the computer, and also (which is of more consequence) increase the value of their observations two-fold.

22 *Royal Circus Street, Greenwich,*
March 8, 1864.

On the Estimated Number of Luminous Particles contained within a defined space on the Sun's Disk. By Edwin Dunkin, Esq.

It may be interesting to record in the *Monthly Notices* of the Society the result of a scrutiny of the solar disk, made on March 10 with the telescope of the Altazimuth, at the Royal Observatory. The small luminous particles identical with the "willow-leaves" of Mr. Nasmyth were seen at intervals distinctly over the whole surface of the Sun, the power used being about 100; and from the peculiar system of wires inserted in the eye-piece of the telescope, I was enabled to form a rough estimation of the number of these particles contained within a definite space.

In the centre of the system of horizontal wires several clear spaces are formed by the intersection of the two central horizontal wires and the six vertical wires. These spaces are nearly square, but they can be more accurately represented by stating that the angular distance between the wires is 56″ in a vertical direction, and 48″ in a horizontal direction. Now the number of particles enclosed at one time within these spaces was estimated to be about three hundred, say, about twenty in one direction and fifteen in the other, and scattered equally about. Mr. Carpenter, who was with me at the time, sensibly confirmed these numbers. As a deduction from these observations, I consider that the average length of these particles is about two seconds, though there are some larger and many smaller.

The aperture of the telescope is about $3\frac{3}{4}$ inches.

With regard to the form of these objects, as exhibited by the Great Equatoreal, I think the "willow-leaf" is very exceptional, and that Mr. Stone's definition, like "grains of rice," is much more applicable. If we take a handful of common grocer's rice, we shall find that the forms are various, some elongated, some round, some broken off sharply. Now I have seen samples of each of these forms in the solar rice, and I know of no better illustration of these phenomena than that exhibited to the Society by Mr. Stone, in which a small quantity of rice was dropped gently and promiscuously on paper covered with an adhesive mixture. The appearance given by this simple experiment gives a fair idea of what can be seen on the solar disk when the observer knows beforehand what kind of object he is in search of.

The "grains of rice" were also visible on the same morning through the telescope of the North Equatoreal. The aperture of the object-glass of this telescope is 4·1 inches.

Greenwich, March 11, 1864.

Note.—On an examination of the Sun's disk with the

Altazimuth, on March 16, I thought that the luminous particles contained in the nearly square spaces appeared to be more thinly scattered than when noticed on March 10. On this second occasion I roughly estimated the number to be about 200.

March 23, 1864.

Mr. Nasmyth's Willow-Leaves. By E. J. Stone, Esq.

The subject of Mr. Nasmyth's "willow-leaves" having been lately brought before this Society, my attention was drawn to the subject. On 1864, Jan. 26, I turned the Great Equatoreal of the Greenwich Observatory on the Sun for the express purpose of looking for these objects. I then distinctly saw the general luminous surface of the Sun irregularly scattered over with bright rice-like particles: these particles were most numerous about the parts of the disk which presented the well-known mottled appearance. I consider the mottled appearance to be produced by the interlacing of these bright particles. Their general shape appeared to me to be far more nearly that of rice than of willow-leaves. I think the description of them as bright rice-like particles is, at least, sufficiently accurate to enable any observer to know exactly what he has to look for, and in this case there appears to be no great difficulty in seeing them. On the day I first saw them, Jan. 26, I called Mr. Dunkin's attention to these particles, and he saw them. They have since been seen on several occasions by myself, Mr. Dunkin, Mr. Ellis, and Mr. Carpenter. On March 10 Mr. Dunkin and Mr. Carpenter saw them with the Shuckburgh telescope of $4\frac{1}{2}$ inches aperture.

Power used, 50·100 Huyghen diagonal reflector.

On early Observations of Uranus by Bradley. By Hugh Breen, Esq.

In a recent examination of Dr. Bradley's unpublished *Greenwich Observations* I have discovered the two following observations of *Uranus*. The first was observed as a star of the sixth magnitude by the transit instrument, and the second by the quadrant:—

New Style.		G.M.S.T. d h m s	R.A. h m s	N.P.D. ° ′
1748	October	21 7 6 18·4	21 4 37·93	107 29
1750	September	13 10 8 57·8	21 40 0·23	104 48

The right ascensions are very accurate.

It had been assumed that the north polar distance in 1750, Sept. 13, was identical with α *Capricorni*, with which it was observed; but some calculations which I have made show me that it was about 5′ greater than that star. I have given the north polar distance accordingly. It was noted as being, on this occasion, of the sixth magnitude.

I intend to make an accurate comparison with Bouvard's Tables, which I hope will be of some use in any future investigations.

Retreat, Lewisham, Feb. 8, 1864.

Mr. Henry Cooper Key, in a letter dated Stretton Rectory, Hereford, Nov. 11, 1863, communicated to the Society a description, illustrated by a drawing, of his stand for a reflecting telescope: the drawing is somewhat too complex for representation in the reduced scale of a woodcut, and without it the description would not be intelligible.

Comet VI. 1863.

The Comet was discovered (see *Ast. Nach.* No. 1456) by Prof. Respighi at Bologna on the 28th Dec. 1863; the original observations being as follows:—

	Bol. M. T.	R.A.	Decl.
	h m s	h m s	° ′ ″
1863, Dec. 28	6 43 4	18 49 24·80	+25 57 33·7
	18 11 2	18 50 1·76	+26 13 2·2

A set of parabolic elements was calculated by Dr. Weisse (*Ast. Nach.* No. 1458), and it was remarked by him that the path closely resembles that of the Comet of 1810: this gives a period of 53½ years; and then, reckoning back six revolutions, it appears that there was, in 1490, a Comet, the path of which also resembles that of the present Comet. But the observations of the present year seem to be better satisfied by an elliptic orbit with a period of about 108 years (see *Ast. Nach.* No. 1465), where Dr. Michez, of the Observatory of Padua, gives the following set of elements from observations, 1864, Jan. 7 and 23, and Feb. 8:—

Perihelion Passage, 1863, Dec. 27·035745 G.M.T.

Log Perihelion Dist.	q	= 9·8854860
,, Mean Daily Motion	μ''	= 15135552
,, Semi-axis Major	a	= 1·3576339
,, Semi-axis Minor	b	= 0·7683839

				Mean Equinox 1864·0
Long. Ascending Node	☊	= 304 52 15·5		
,, Perihelion	ϖ	= 59 40 8·3		
Inclination	ι	= 63 56 28·8		
Angle of Excentricity	φ	= 75 4 45·1		
Period	T	= 1087·76		

Motion direct.

The error for the mean observation being thus:—

Long. O − C = + 1″·5 Lat. O − C = − 0″·5

The identity of the Comet with that of 1810 is thus doubtful.

Minor Planet ⑲ *Eurynome.*

Discovered by Mr. Watson, Director of the Ann Arbor Observatory, 14th Sept. 1863.

The following set of elements, calculated by Mr. W. A. Royers, from the *Washington Observations*, to Dec. 14, from twelve Ann Arbor observations, and from thirty-five observations by himself at the Alfred University Observatory, from which were computed normal places for 1863, Sept. 24, Oct. 18 and 30, Nov. 19, and Dec. 5, are given, *Ast. Nach.* No. 1465:—

Epoch, 1863, Sept. 19 G.M.T.

M	=	334 43 16·9
ϖ	=	44 13 28·7
☊	=	206 40 54·7
ι	=	4 36 49·1
φ	=	11 14 28·9
log *a*	=	0·3880180
μ	=	928″·92424

In the *Comptes Rendus*, 7th March, 1864, there is contained a paper by M. Faye, "On a New Method proposed by M. de Littrow, for Determining the Time and the Longitude at Sea." The method was tried on the voyage of circumnavigation of the Austrian frigate, the Novara, and after trial was adopted by the Commander Admiral von Wüllerstorf, as part of the daily routine of the vessel. These results attracted the attention of M. Faye, and M. de Littrow having requested him to make the method known in France, he accordingly communicated it to the Academy.

The method consists in the determination of the time by two circummeridional observations of the Sun, preserving at the same time the observation of the true noon for the latitude. The two altitudes may be taken at pleasure on the same side or on opposite sides of the meridian: the interval of time is arbitrary, varying, according to the circumstances, from 5 to 30 or 40 minutes; and as the calculation takes only 5 minutes, the navigator may in half-an-hour take his observations, and effect all the calculations necessary for finding at once the longitude and the latitude. It is to be observed that the two determinations are independent of each other, and that thus the method is not to be considered as merely a bold extension of the method of Douwes, one of whose fundamental equations is made use of. So far from replacing the habitual meridian observations, the new method is an aid to it by giving beforehand an approximate determination of the time of culmination.

The new idea depends on the remark that, when, as at sea, a scrupulous accuracy is not required, the circummeridional altitudes of the Sun may be used for determining the time Using h and h' to denote the altitudes taken at the times t and t' of the chronometer; T and T′ the corresponding hour-angles; φ the latitude, and δ the declination: then, in order to determine the mean $\frac{1}{2}(T + T')$ of the unknown hour-angles, there is the relation already familiar to navigators

$$\sin \frac{1}{2}(T + T') = \frac{\sin \frac{1}{2}(h' - h)}{\sin \frac{1}{2}(T - T)} \cdot \frac{\cos \frac{1}{2}(h' + h)}{\cos \varphi \cos \delta};$$

but which is only applied by them to observations, of which one, at least, is taken as far as possible from the meridian.

As an example, M. Faye gives as follows:—

Suppose that, for a place 20° north latitude on the 25th August, 1864, there are taken the following observations about 30 and 15 minutes before true noon:—

At 3 h 31 m 45 s Paris Mean Time	h = 78° 6′ 19″	δ = 10° 33′
3 46 45	h' = 79 52 49	

thence

$\frac{1}{2}(T - T') = 1^\circ 52' 30''$ $\qquad$ $\frac{1}{2}(t + t') = 3^h 39^m 15^s$

$\frac{1}{2}(h' - h) = 0\ 53\ 15$ $\qquad$ $\frac{1}{2}(h' + h) = 78^\circ 59' 34''$

and

log sec φ	0·02701
log sec δ	0·00740
log cos $\frac{1}{2}(h' + h)$	9·28088
log cosec $\frac{1}{2}(T - T')$	1·48520
log sin $\frac{1}{2}(h' - h)$	8·19000
log sin $\frac{1}{2}(T + T')$	8·99040

$\frac{1}{2}(T + T')$ . . . . $5^\circ 36' 52'' = 0^h 22^m 27^s$ E.

whence

	h	m	s
True Local Time	23	37	33
Equation of Time		1	45
Mean Local Time	23	39	18
Paris Time	3	39	15
Longitude, West	3	59	57

and for the ordinary meridian observation by the chronometer, the instant of true noon will be $4^h\ 1^m\ 42^s$.

	°	′	″
Observed Altitude	80	32	26
Decl. + 90°	100	32	36
φ, Concluded Latitude	20	0	10

For estimating the probable error of the determination, M. Faye forms the equation,

$$\frac{d\,.\,\frac{1}{2}\,(T+T')}{\tan\frac{1}{2}\,(T+T')} = \frac{d\,.\,\frac{1}{2}\,(h'-h)}{\tan\frac{1}{2}\,(h'-h)} - \frac{d\,.\,\frac{1}{2}\,(h+h')}{\cot\frac{1}{2}\,(h'+h)} + \frac{d\,\varphi}{\cot\varphi},$$

which, with the foregoing numerical values, gives, if $dL = \frac{1}{15}\,d\,.\,\frac{1}{2}\,(T+T')$, the error of longitude expressed in time,

$$dL = 0^s{\cdot}422\,d\,.\,\tfrac{1}{2}\,(h'-h) - 0^s{\cdot}034\,d\,.\,\tfrac{1}{2}\,(h'+h) + 0^s{\cdot}0024\,d\,\varphi;$$

and thence, taking as probable amounts for the errors, $d\varphi = 10'$, $d\,\frac{1}{2}\,(h'+h) = 1'$, $d\,\frac{1}{2}\,(h'-h) = 13''$, the resulting portions of the error dL are $1^s{\cdot}44$, $2^s{\cdot}04$, and $2^s{\cdot}74$, and the final error to be feared is

$$\sqrt{2{\cdot}74^2 + 2{\cdot}04^2 + 1{\cdot}44^2} = \pm 3^s{\cdot}70;$$

that is to say, about an error of 1 nautical mile. But the example is a favourable one for the method; and it is not always that so much precision would be obtained; for instance, if the observations had been made in winter, instead of summer, the 20th February instead of 25th August, then, with the same errors of observation, the resulting error in the longitude would be $\pm\ 7^s{\cdot}70$, or about 2 nautical miles. He concludes that the method, as above explained, furnishes excellent results for culminations near the zenith; in the contrary case the precision diminishes, but it is easy to bring it up to the required accuracy by increasing the interval between the circummeridional observations: the only exception is for the regions of

the globe and the circumstances of the sea, for which all possible methods are in defect.

M. Faye remarks, that the method might be equally useful on *terra firma* as at sea: for travellers, as well as sailors, it would be useful to have a convenient method of determining daily their latitude and longitude by observations concentrated at a single epoch of the day, about noon; and he suggests the employment in this case of a correction for the variation of the Sun's declination, as follows:—

Differentiating the equation

$$\sin h = \sin \varphi \sin \delta + \cos \varphi \cos \delta \cos T$$

in regard to h and δ, and in the result replacing cos T by unity, we have

$$\frac{dh}{d\delta} = \frac{\cos h_{,}}{\cos h},$$

where $h_{,}$ is the meridian altitude of the Sun. This ratio being sensibly $= 1$, except in the case of a culmination very near the zenith, $d\delta$ may be taken for dh, which gives the rule. "In order to take account of the change of declination in the interval of the two measures, subtract it from the second altitude when the change tends to elevate the Sun; add it in the contrary case."

The rule fails for a culmination near the zenith, but the correction is then of less importance, on account of the smallness of the coefficient of $d\,\frac{1}{2}\,(h' - h)$ in the expression of $d\,L$; the correction may however be calculated from the equation

$$dh = d\delta \cos S,$$

where S is the angle at the Sun, given by the equation

$$\frac{\sin S}{\sin \varphi} = \frac{\sin T}{\cos h}.$$

It is easy, also, to correct the error introduced by the employment of an estimated value of the latitude, and so in the expression for $d\,L$ to get rid of the term depending on $d\varphi$. And, lastly, if by any accident the meridian observation is wanting, the ordinary reduction to the meridian may be applied to one of the observed altitudes, so as to obtain with sufficient accuracy the meridian altitude, and thence the latitude.

Note by the Astronomer Royal on a Passage in Captain Jacob's "Measures of Jupiter and his Satellites taken with the Madras Equatoreal."

In the very admirable paper of the late Captain Jacob, printed in vol. xxviii. of the Royal Astronomical Society's *Memoirs*, in the section "Mass of *Jupiter*," page 110, when describing the process of reducing the measures of elongation of *Jupiter's* satellite IV., which is done by use of my tables in vol. vi. of the *Memoirs*, page 91, Captain Jacob remarks, "My reason for not adopting Mr. Airy's epoch was, that it was not apparent whether the light-equation was included in it or not."

It is curious that Captain Jacob should not have noticed the explicit statement by myself, which follows the cited tables at an interval of a single page. In page 92 of vol. vi. I state, "The times in the table in Section I. are diminished by the light-equation corresponding to 20″·5 constant of aberration, and the geocentric place of the satellite is calculated &c." Before commencing that calculation, the times obviously are not so diminished, or the light-equation is not included.

I have referred to the original calculations, and I find that all are conducted in conformity with this statement.

March 10, 1864.

A paper has been received from Mr. H. P. Finlayson, dated Dover, March 4th, 1864, noticing the following relation:—

Period of rotation of the Earth on its axis
: Periodic time of Moon round the Earth
: : Period of rotation of Sun on its axis
: Periodic time of *Mars* round the Sun,

viz.

1 : 27·32166 : : 25·188 : 686·979645,

which, as the author imagines, probably subsists with an absolute mathematical precision, and from which he deduces various results.

RECENT PUBLICATION.

Practical and Spherical Astronomy, for the use chiefly of Students in the Universities. By the Rev. R. Main, Radcliffe Observer at Oxford. Cambridge and London, 1863.

Mr. Main's excellent work has been already referred to in the Report of the Council to the last Annual Meeting of the Society. The author states that his object has been to include both in the practical and theoretical portions of the volume all the mathematical processes which will enable the reader to understand the operations of a modern Observatory, furnished with the ordinary meridional and extra-meridional instruments, so that he might readily acquire, if called upon to do so, by actual practice in an observatory, the additional and more minute details which occur in the making and reducing of observations; while, therefore, in the description of the instruments, the details of their construction are not minutely entered into, on the other hand, the author hopes that there is scarcely a process used at Greenwich, or our other great English Observatories, which is left unexplained, and that a student will be enabled, by the help of the treatise and by suitable tables, to reduce every class of observations which will be found in their annals, or to examine the accuracy of their results. The especial value of Mr. Main's treatise consists in this happy combination of its mathematical and practical bearing, leading the student right up to the Observatory, and furnishing him with the very best methods of applying what, up to that point, must otherwise be in general half comprehended theory. The execution is such as might be expected from the position and character of the author, and it is almost needless to say that the work may be relied on as furnishing an accurate representation of the present practice of astronomy.

Curiously enough, the author has omitted the only method of finding the azimuth error of a transit, which is really and readily applicable for a small instrument, viz., by observing a high and a low star: a method invaluable where the clock is not absolutely first-rate, and where, as in all portable instruments, the aperture of the telescope is small.

There will be read at the ensuing Meeting of the Society, on the 8th April, a paper by A. Herschel, Esq. "On the Connexion between the number of Meteorolites, as visible at any place, and their planetary nature."

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